CLAIMS

1. Method for modulating at least one symbol to be transmitted from a transmitter entity towards at least one receiver entity, said at least one symbol being issued from at least one physical channel, said method comprising :

- a step for assigning a spectrum spreading code to each of said at least one physical channel,
- a step for generating at least one spectrum spreading code, said at least one spectrum spreading code being taken from a set of orthogonal spreading codes with variable spreading factor, and
- a step for multiplying each of said at least one symbol of each of said at least one physical channel by the generated spectrum spreading code assigned to the physical channel under consideration,

characterised in that said step for generating at least one spectrum spreading code consists of generating at least one spectrum spreading code comprising a sequence of chips wherein at least one chip has the value 0, each of the chips with value 0 included within a spectrum spreading code thus generated, then called discontinuous spectrum spreading code, creating, for the physical channel to which said discontinuous spectrum spreading code is assigned, a transmit power approaching zero for the corresponding transmitted signal.

2. Method according to Claim 1, characterised in that said sequence of chips further comprises chips with value -1 or +1.

3. Method according to any of Claims 1 and 2, characterised in that said step for assigning a spectrum spreading code to each of said at least one physical channel precedes said step for generating at least one spectrum spreading code.

4. Method according to any of Claims 1 to 3, characterised in that the spectrum spreading codes with 2^N chips are defined by row vectors of a matrix with 4^N rows and 2^N columns resulting from the Kronecker product $H \otimes H \otimes \ldots \otimes H$ comprising N factors H, $\otimes$ being the Kronecker product operator and where $H = \begin{bmatrix} 1 & 1 \\ 1 & -1 \\ 1 & 0 \\ 0 & 1 \end{bmatrix}$.

5. Method according to any of Claims 1 to 3, characterised in that the spectrum spreading codes with 2^N chips are defined by row vectors of a matrix with 2^N rows and 2^N columns resulting from the Kronecker product $H_1 \otimes H_2 \otimes H_3$, $\otimes$ being the Kronecker product operator and where

- H_1 is equal to the result of the Kronecker product $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \otimes \ldots \otimes \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ comprising a number I of factors $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$,
- H_2 is equal to the result of the Kronecker product $\begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix} \otimes \ldots \otimes \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$ comprising a number J of factors $\begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$,

- H_3 is equal to the result of the Kronecker product $\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}\otimes\ldots\otimes\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$ comprising a number K of factors $\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$, and
- N is equal to the sum of the respective numbers I, J and K of product factors whose results are said matrices H_1, H_2 and H_3.

6. Method according to any of Claims 3 to 5, characterised in that, at least two spectrum spreading codes being included within a list of spectrum spreading codes possibly structured according to a so-called tree structure, said method comprising a step for selecting a spectrum spreading code to be assigned within said list, the selection of said spectrum spreading code to be assigned being carried out according to at least one order number (SF,n) specific to the physical channel to which said selected spectrum spreading code is to be assigned, and a step for permuting said at least two spectrum spreading codes within said list, said permutation step consisting of carrying out at least one permutation of said at least two spectrum spreading codes within said list, each of said at least one permutation being carried out in a pseudo-random way according to a predetermined period, called permutation period (τ),
in that said selection and assignment steps are repeated after at least one permutation,
and in that, after each of said assignment steps, said generation step stops to generate the spectrum spreading code assigned before the permutation under consideration, and generates the spectrum spreading

code assigned after the permutation under consideration.

7. Method according to Claim 6, characterised in that, said selection and assignment steps being repeated according to a predetermined period, called selection period (T), said selection period being a multiple of said permutation period (τ), said selection period corresponds to a number (T) of chips representing the maximum number of chips within a spectrum spreading code.

8. Method according to any of Claims 6 and 7, characterised in that, the number of chips per symbol (SF) being constant, for each of said at least one physical channel to which is assigned a spectrum spreading code, during a period of a radio frame, said permutation period corresponds to a number (τ) of chips which is a divisor of the minimum number of chips within a symbol, said minimum number being considered for all of said at least one physical channel.

9. Method according to Claim 8, characterised in that said selection and assignment steps are repeated according to a predetermined period, called selection period (T), corresponding to a multiple of said number of chips per symbol (SF) during said period of a radio frame.

10. Method according to any of Claims 6 to 9, the spreading factor of a spectrum spreading code corresponding to the number of chips included within this spectrum spreading code, characterised in that said permutation step consists of substituting for said at least two spectrum spreading codes within said list,

a spectrum spreading code with the same spreading factor.

11. Method according to any of Claims 6 to 10, characterised in that, said list being structured according to a binary tree structure, said permutation step preserves said binary tree structure.

12. Method according to any of Claims 1 to 11, characterised in that it is implemented in said transmitter entity after the reception by said transmitter entity of a request message, called first request message, transmitted by said at least one receiver entity.

13. Method according to any of Claims 1 to 12, characterised in that it is deactivated after the reception by said transmitter entity of a request message, called second request message, transmitted by said at least one receiver entity.

14. Method according to any of Claims 1 to 11, characterised in that it is implemented on initiative of said transmitter entity.

15. Method according to any of Claims 1 to 13, characterised in that said transmitter entity transmits to said at least one receiver entity at least one message, called transmit power information message, comprising at least one measurement result of the transmit power of the corresponding signal transmitted for a predetermined transmission period.

16. Method according to Claim 15, characterised in that said transmit power information message is transmitted with a predetermined period, called information period.

17. Method according to any of Claims 15 and 16, itself dependent on Claim 12, characterised in that

said first request message is transmitted when said measurement result of the transmit power of the signal transmitted is lower than a predetermined threshold, called first threshold.

18. Method according to any of Claims 15 to 17, itself dependent on Claim 13, characterised in that said second request message is transmitted when said measurement result of the transmit power of the signal transmitted is higher than a predetermined threshold, called second threshold.

19. Method according to any of Claims 1 to 18, characterised in that said discontinuous spectrum spreading code is defined with at least three parameters, a first parameter SF_{dmin} representative of the minimum value of a discontinuity factor of the discontinuous spectrum spreading code, said discontinuity factor corresponding to the ratio of the total number of chips to the number of chips with non zero value, a second parameter SF_{emin} representative of the minimum value of an effective spreading factor of the discontinuous spectrum spreading code, said effective spreading factor corresponding to the number of chips with non zero value within the discontinuous spectrum spreading code, a third parameter SF_{emax} representative of the maximum value of said effective spreading factor.

20. Device for modulating at least one symbol to be transmitted from a transmitter entity towards at least one receiver entity, said at least one symbol being issued from at least one physical channel, said device comprising:

- means for assigning a spectrum spreading code to each of said at least one physical channel,
- means for generating at least one spectrum spreading code, said at least one spectrum spreading code being taken from a set of orthogonal spreading codes with variable spreading factor, and
- means for multiplying each said at least one symbol of each said at least one physical channel by the generated spectrum spreading code assigned to the physical channel under consideration,

characterised in that said means for generating at least one spectrum spreading code generate at least one spectrum spreading code comprising a sequence of chips wherein at least one chip has the value 0, each of the chips of value 0 included within a spectrum spreading code thus generated, then called discontinuous spectrum spreading code, creating, for the physical channel to which said discontinuous spectrum spreading code is assigned, a transmit power approaching zero for the corresponding transmitted signal.

21. A mobile station comprising means for transmitting at least one physical channel, each of said at least one physical channel carrying at least one symbol, characterised in that it comprises a modulation device according to Claim 20.

22. Method for demodulating at least one symbol received by a receiver entity, said at least one symbol being issued from at least one modulated physical channel, said method comprising:

- a step for assigning a spectrum despreading code to each of said at least one modulated physical channel, said spectrum despreading code

corresponding to the spectrum spreading code being used for modulating a physical channel to be modulated and to be transmitted,

- a step for generating at least one spectrum despreading code, said at least one spectrum despreading code being taken from a set of orthogonal despreading codes with variable despreading factor, and
- a step for correlating each of said at least one symbol of each of said at least one modulated physical channel, said correlation step consisting of correlating the symbol under consideration with the generated spectrum despreading code assigned to the modulated physical channel under consideration,

characterised in that said step for generating at least one spectrum despreading code consists of generating at least one spectrum despreading code comprising a sequence of chips wherein at least one chip has the value 0.

23. Method according to Claim 22, the despreading factor of a spectrum despreading code corresponding to the number of chips included within this spectrum despreading code, said at least one modulated physical channel comprising at least one modulated physical channel with variable spreading factor, the spreading factor of a modulated physical channel corresponding to the number of chips per symbol of said modulated physical channel, the spectrum despreading code to be assigned to each of said at least one modulated physical channel with variable spreading factor being selected from within a list assigned to said modulated physical channel with variable spreading factor, each

of said at least one list comprising a unique spectrum despreading code for each of said possible spreading factors for the modulated physical channel to which the list under consideration is assigned,

characterised in that, each of the spectrum despreading codes of each of said at least one list being the result of the Kronecker product of a factor (V) common to all of the spectrum despreading codes of the list under consideration, called first factor, and a factor (U) specific to the spectrum despreading code under consideration, called second factor,

said method comprises for each of said at least one list :

- a step for generating said first factor (V),
- a step for correlating, called first correlation step, at least one time segment relative to each of said at least one symbol of said at least one modulated physical channel by said generated first factor, a sequence of intermediary chips for each of said at least one symbol being thus obtained, each of the intermediary chips resulting from said correlation,
- a step for determining said second factor, and
- a step for correlating, called second correlation step, the corresponding sequence of intermediary chips obtained with said second factor, for each of said at least one symbol.

24. Device for demodulating at least one symbol received by a receiver entity, said at least one symbol being issued from at least one modulated physical channel, said device comprising:

- means for assigning a spectrum despreading code to each of said at least one modulated physical channel, said spectrum despreading code corresponding to the spectrum spreading code being used for modulating a physical channel to be modulated,
- means for generating at least one spectrum despreading code, said at least one spectrum despreading code being taken from a set of orthogonal despreading codes with variable despreading factor, and
- means for correlating each of said at least one symbol of each of said modulated physical channel with the generated spectrum despreading code assigned to the modulated physical channel under consideration,

characterised in that said means for generating at least one spectrum despreading code generate at least one spectrum despreading code comprising a sequence of chips wherein at least one chip has the value 0.

25. A base station comprising means for receiving at least one modulated physical channel, each of said at least one modulated physical channel carrying at least one symbol, characterised in that it comprises a demodulation device according to Claim 24.